MEMORANDUM

TO: Toni Jones, U.S. Environmental Protection Agency

FROM: Eastern Research Group, Inc.

DATE: January 12, 2011

SUBJECT: Revised Baseline Emissions and Emissions Reductions Estimates for Existing CISWI Units

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BACKGROUND

The U.S. Environmental Protection Agency (EPA), under section 129 of the Clean Air Act (CAA), is required to regulate emissions of nine pollutants from Commercial and Industrial Solid Waste Incineration (CISWI) units: hydrogen chloride (HCl), carbon monoxide (CO), lead (Pb), cadmium (Cd), mercury (Hg), particulate matter (PM), dioxins/furans (PCDD/PCDF), nitrogen oxides (NO_x), and sulfur dioxide (SO_2).

On December 1, 2000, EPA adopted new source performance standards and emission guidelines for commercial and industrial solid waste incineration units established under Sections 111 and 129 of the Clean Air Act. In 2001 EPA was granted a petition for reconsideration regarding the definitions of "commercial and industrial waste" and "commercial and industrial solid waste incineration unit." In 2001, the United States Court of Appeals for the District of Columbia Circuit granted EPA's voluntary remand, without vacatur, of the 2000 rule. In 2005, EPA proposed and finalized the commercial and industrial solid waste incineration definition rule which revised the definition of "solid waste," "commercial and industrial waste," and "commercial and industrial waste incineration unit." In 2007, the United States Court of Appeals for the District of Columbia Circuit vacated and remanded the 2005 commercial and industrial solid waste incineration definition rule.

These final standards provide EPA's response to the voluntary remand that was granted in 2001 and the vacatur and remand of the commercial and industrial solid waste incineration definition rule in 2007. In addition, the standards re-development includes the 5-year technology review of the new source performance standards and emission guidelines required under Section 129. The EPA has developed a series of maximum achievable control technology (MACT) floor options to support that re-development. The development of the MACT floors used to determine these options is discussed in more detail in a separate memorandum.[1] The purpose of this memorandum is to present baseline emissions estimates for existing sources and anticipated emissions reductions that would result from compliance with the final standards.

This memo is organized as follows:

I. Emissions Reductions Summary
II. Baseline Emissions
III. MACT Floor Emissions
IV. Lowest Cost Floor Emissions

I. Emissions Reductions Summary

The current population of CISWI units is estimated to consist of 88 units. This population represents the estimate of CISWI units that would still be burning waste materials upon implementation of the rule. Waste-burning kilns that are considered "waste-burning" solely due to burning whole tires are assumed to be able to find a source of whole tires that would not be considered a waste prior to implementation, and would thus be subject to the provisions of the Portland Cement NESHAP instead of CISWI.

Emissions reductions for the CISWI units were calculated for each of the nine pollutants (plus particulate matter less than 2.5 microns ($PM_{2.5}$)) for two scenarios: 1) Assuming each existing unit complied with the final emissions limits, and 2) Assuming that units would comply using the lowest cost alternative, either complying with the emission limits or ceasing to use the combustion device and utilizing less costly alternatives, such as landfilling solid waste materials.

Under the first scenario (MACT Floor Emission Reductions), we estimate 37,540 tons per year of emissions would be reduced, consisting of 431 tons of HCl, 23,450 tons of CO, 4.5 tons of Pb, 0.90 tons of Cd, 0.11 tons of Hg, 1,670 tons of PM, 0.0001 tons of PCDD/PCDF, 5,630 tons of NO_x, and 5,210 tons of SO_2. Under the second scenario (Lowest Cost Alternative Emissions Reductions), we estimate 36,530 tons per year of emissions would be reduced, consisting of 440 tons of HCl, 23,410 tons of CO, 4.5 tons of Pb, 0.90 tons of Cd, 0.11 tons of Hg, 1,670 tons of PM, 0.0001 tons of PCDD/PCDF, 5,730 tons of NO_x, and 5,260 tons of SO_2.

Table 1 presents the anticipated emissions reductions by subcategory assuming all units remain operating and comply with the final emission limits. Table 2 presents the anticipated emissions reductions by subcategory assuming units either comply or cease operation and use alternative disposal methods, depending on which option costs less. Table 2 also includes estimates of secondary air emissions that would result from landfilling the diverted waste materials and flaring the landfill gas that these wastes would generate.

II. Baseline Emissions

Baseline emissions represent the estimated annual emissions of existing units prior to retrofit of controls to comply with the final emission limits.

<u>Calculation Methodology.</u> Annual emissions estimates are calculated using the pollutant concentration (mass per stack gas volume) multiplied by the flue gas flow rate (dry standard cubic feet per minute) and the time (hours per year) the unit is operated. Appendix A presents the calculations needed to convert from the standard pollutant concentrations to the annual tons emitted.

<u>Pollutant Concentration data.</u> Pollutant concentration data measured from emissions tests for the unit were used whenever available. When there were data gaps, these were filled first by using the same measured data from similar units operated by the corporate entity. If these data were not available, then subcategory default values were assigned for the unit. These default values were the mean of the actual emissions test values measured for the units within a subcategory.

For waste-burning kilns, we assumed that these units would likely be complying with the final and proposed Portland Cement NESHAP limits prior to, or in absence of, complying with the final CISWI emission limits. As a result, for the pollutants that are covered by the Portland Cement NESHAP that are also CAA section 129 pollutants, the baseline emissions should reflect the Portland Cement NESHAP limits. We compared the available test data to the final Portland Cement NESHAP limits for pollutants that overlap the nine section 129 pollutants. If the measured value was lower than the final Portland Cement NESHAP limit, then the test data were used. Otherwise, if the measured data were greater than the final Portland Cement NESHAP limit, then the Portland Cement NESHAP limit was applied as a baseline concentration for that unit.

The pollutants and limits from the Portland Cement NESHAP that were applied to waste-burning kiln baseline emissions are:

- HCl – 3 parts per million volume dry (ppmvd).
- PM – 6.407 milligrams/dry standard cubic meter (mg/dscm).
- Dioxins/furans (TEQ) – 0.2 nanograms/dry standard cubic meter (ng/dscm).
- Dioxins/furans (TMB) – The PC NESHAP limit is 0.2 ng/dscm TEQ. CISWI allows TMB or TEQ compliance. However, CISWI emissions reductions estimates are established using TMB. Therefore, we used the actual reported TMB data for the unit or average value for all waste-burning kilns if no TMB data were available for a baseline for our emission reduction and costing comparisons.
- Hg – 0.0088 mg/dscm. The NESHAP limit for Hg is given as 14 lb/million tons of clinker. This limit was converted to a mg/dscm approximation by calculating the gr/dscf to lb/ton clinker ratio used for the PM limit calculations in the NESHAP. This ratio is 0.07882 and is calculated using this relationship: 0.0067 grains/dry standard cubic foot = 0.085 lb/ton clinker. Therefore, 14 lb Hg/1,000,000 ton clinker x 0.07882 (gr/dscf)/(lb/ton clinker) x lb/7000 gr x 453,592 mg/lb x 35.3145 dscf/dscm = 0.00253 mg/dscm.

<u>Flue Gas Flow Rate and Operating Hours.</u> The flue gas flow rate and annual operating hours used to calculate emissions were similar to those that were used as inputs for control costing algorithms. Each unit's baseline emissions are based on unit average test data for each pollutant. Actual emissions test data and survey data from the CISWI database were used whenever available. Similar unit values were used if there were any data gaps for a similar unit operated by the entity. Lastly, F-factor estimates or subcategory default values were applied as necessary to fill in the remaining gaps in flue gas flow rates. The flue gas flow rate data gap filling procedures are discussed in more detail in the control costing memorandum.[2]

Table 3 presents the baseline concentration, hours of operation, stack gas flow rate, and annual emissions estimates for each of the CISWI units.

III. MACT Floor Emissions

MACT floor emissions are the estimated annual emissions that would result from CISWI units complying with the MACT floor emissions limits. These were calculated by using the same equations that were used for the baseline emissions that are listed in Appendix A. However, the final MACT floor emissions limit is used as the pollutant concentration if the baseline concentration exceeds the final limit value. If a unit's baseline pollutant concentration is below the final emissions limit, then that concentration was used to calculate the MACT floor emissions as well (i.e., no backsliding or emissions increases would occur). Additionally, for units expected to require the addition of fabric filters to meet one or more pollutant limits, a reduction efficiency of 99% was applied to their baseline values for Cd, Pb,and PM to determine their MACT floor emissions for these pollutants to fully account for the co-control for all of these pollutants due to the addition of a high-efficiency fabric filter.

Table 4 presents the estimated MACT floor emissions for each unit as described above. Hours of operation and stack gas flow rates used to determine tons per year are also included. Table 5 puts the baseline and MACT floor emissions estimates together and presents the annual emissions reductions for each CISWI unit.

Table 5 also presents the amount of $PM_{2.5}$ emissions reduction anticipated for each unit. These emissions are calculated as a percent of the PM filterable emissions reductions. These fractions were based on emission factors from EPA's AP-42 document[3], and are a function of the materials burned and the baseline control devices (if any) present on the unit. These $PM_{2.5}$ fraction factors are presented in Appendix B.

IV. Lowest Cost Floor Emissions

Two of the CISWI subcategories have potential alternatives to incineration that could be more economical than complying with the final CISWI standards. The incinerator and small, remote incinerator subcategories could cease to burn solid waste and instead divert this waste to a landfill for disposal. The costs of complying with the rule and those associated with these disposal alternatives are discussed in more detail in the control costing memorandum.[2] The cost estimates indicate that all but three of the incinerators would cease using the combustion unit and use alternative disposal rather than adding controls necessary to comply with the final standards. The three incinerators that would likely remain operating are ILFlintHillsResources MB-1012, LAShellChemical F-T701, and SCEastmanColumbia 1560-0008 ID #15. For the small remote subcategory, we estimate that no units would shut down, but that for many units it would be less expensive to segregate their waste and divert the nonferrous metal and chlorinated plastic to a landfill, rather than install the controls necessary to comply with the limits if no waste segregation were being practiced. This is possible for this particular subcategory since the waste these units are burning is primarily municipal-type waste from industrial sites, which is usually able to be segregated for recyclable materials. The waste segregated out is assumed to be non-digestable or minimally digestible materials such as ferrous and non-ferrous metals and PVC, and therefore would not contribute significantly to landfill gas emissions. By removing these materials from the waste stream, it is expected that these small remote units will be able to meet the PCDD/PCDF and Hg MACT floor limits.

When incinerators cease combusting waste, the waste that is diverted to a landfill will generate landfill gas (methane, carbon dioxide, hydrogen sulfide, chlorine gas, and other trace constituents). This waste may likely be combusted by a landfill flare, which would generate some emissions. These landfill flare emissions would be considered a secondary air impact to the final CISWI rule, since the waste that generates the landfill gas was diverted to the landfill due to the rule. The potentially diverted waste estimates are presented in the control costing memorandum[2], but were estimated based on the unit's waste combustion capacity and the annual operating hours. The waste diverted estimates were then assumed to be steady for 20 years (the expected useful life of a CISWI unit) to calculateestimates of the landfill gas generated from the diverted waste. These estimates were calculated using a first-order decay model (EPA's Landfill Gas Emissions Model (LandGEM) Version 3.02).[4] Then, LandGEM default landfill gas sulfur and chlorine concentrations, along with landfill gas flare emissions factors from EPA's AP-42 were then used to calculate annual secondary air impact emissions from the landfilling of the diverted solid waste. The LandGEM model inputs, flare emission factors, and calculated emissions are presented in Appendix C. These emissions were then subtracted from the total emission reductions to get an adjusted annual emissions reduction in Table 2.

REFERENCES

1. "CISWI Emission Limit Calculations for Existing and New Sources" Memorandum from Eastern Research Group, Inc. to Toni Jones, U.S. Environmental Protection Agency. January 12, 2011.

2. "Revised CISWI Control Costs" Memorandum from Eastern Research Group, Inc. to Toni Jones, U.S. Environmental Protection Agency. January 12, 2011.

3. U.S. EPA. Compilation of Air Pollutant Emission Factors, Vol. 1. (AP-42) Fifth Edition. 1995.

4. U.S. EPA Office of Research and Development. Landfill Gas Emissions Model (LandGEM) Version 3.02. May 2005.

APPENDIX A

CONVERSION CALCULATIONS

The following calculations were used to develop ton/year emission estimates:

PM, Pb, Cd and Hg

Concentration ”X” given in mg/dscm, flow rate ”FR” in dscf/minute (dscfm), and annual hours ”H” (hours/year):

[X(mg/dscm) x FR(dscf/min) x 60(min/hr) x H(hr/year)] ÷
[35.3147(dscf/dscm) x 453,592(mg/lb) x 2,000(lb/ton)] = (ton/yr)

CDD/CDF

Concentration ”X” given in ng/dscm, flow rate ”FR” in dscf/minute (dscfm), and annual hours ”H” (hours/year):

[X(ng/dscm) x FR(dscf/min) x 60(min/hr) x H(hr/year)] ÷
[35.3147(dscf/dscm) x 1,000,000 (ng/mg) x 453,592(mg/lb) x 2,000(lb/ton)] = (ton/yr)

HCl, NOx, SO_2, CO

Concentration ”X” given in ppmvd, flow rate ”FR” in dscf/minute (dscfm), annual hours ”H” (hours/year), and molecular weight ”MW” as follows: HCl = 36.45, NOx = 46, SO2 = 64.06, CO = 28.01:

[X(ppmvd) x MW(lb/lbmol) x FR(dscf/min) x 60(min/hr) x H(hr/year)] ÷
[1,000,000 x 385.5(dscf/lbmol) x 2,000(lb/ton)] = (ton/yr)

APPENDIX B

PM2.5 FRACTION INFORMATION

APPENDIX C

LANDFILL GAS AND FLARE EMISSIONS ESTIMATES